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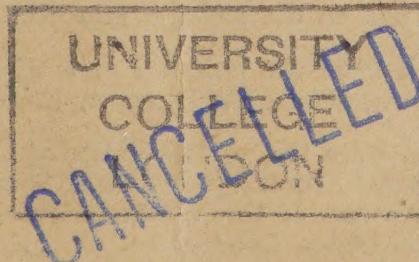
GREAT BRITAIN. Medical Research Committee, of the
 MEDICAL RESEARCH COUNCIL
 INDUSTRIAL HEALTH RESEARCH BOARD

[Miscellaneous publications]

HEALTH RESEARCH IN INDUSTRY

(Proceedings of a Conference on Industrial Health Research held at the London School of Hygiene and Tropical Medicine, 28th September, 1944)

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HEALTH RESEARCH IN INDUSTRY

(Proceedings of a Conference on Industrial Health Research, held at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1., on Thursday, 28th September, 1944)

MORNING SESSION

CHAIRMAN: Sir Edward MELLANBY, K.C.B., M.D., F.R.C.P., F.R.S.
(Secretary, Medical Research Council)

THE WORK OF THE INDUSTRIAL HEALTH RESEARCH BOARD

Sir Edward MELLANBY:—It has been announced that the Chairman of the Industrial Health Research Board, the Earl De La Warr, would preside at this conference, but unfortunately, to his great regret, he cannot be present today. In taking his place, I find myself in the peculiar position of being able to give on his behalf an excuse which would probably never previously have been valid since the days of Solomon and the Queen of Sheba, namely that he is in conference with the Ethiopians, but that is the fact. When he decided that he must accept the invitation of the Government to undertake the mission to the Emperor of Abyssinia, he wanted to postpone this meeting so that he might be able to attend it. It was, however, considered impossible to change the date, since the invitations had been sent out and all the arrangements had been so definitely made.

In welcoming you here today on behalf of the Medical Research Council and their Industrial Health Research Board, I should like to say that we all agree with Earl De La Warr that conferences of this kind are of the greatest importance and assistance to the work of the Board. Research workers have the reputation of being recluses, and of caring little whether their discoveries have any practical significance or are subject to practical development, but I assure you that this is not true today. As many of you know, men who are doing research have a most exacting job and by its very nature, they are cut off from many social contacts. Moreover, they have not the attributes of salesmen. If they had, they would no doubt find that form of life much easier and more lucrative; but just because they have not these qualities, it is essential that they should be afforded from time to time an opportunity, such as is presented by this widely representative conference, of at least being able to display their goods and of giving the public an opportunity to appraise their value.

Conferences on industrial health are important for many other reasons. An investigator in the subject cannot survey the whole of industry and out of his own intuition decide what are the most important points requiring research; he must rely on those in close association with industry to tell him what problems most need his attention. On this account, we particularly welcome Lord Forrester, who is going to place before the conference the point of view of the employers, and Mr. Isaacs, who will put that of the trade union workers. I am sure that we shall find these different points of view and experience of great value and interest. It should also be remembered that industrial health research investigators, although working for the Medical Research Council, a body set up by and financed by the Government with a mandate to carry out this branch of research, have no right of access to works or to examine workmen. To obtain these facilities, they must rely on the good will of employers and employees, and, for that reason again, a conference such as we

are holding today should be very useful. Research workers on industrial health have but one object in view, and that is to obtain facts and elucidate problems in order to improve conditions in industry. They have no axe to grind, and no particular interest in one side of industry more than another. On the other hand, the work which is done by professional researchers can be only a part of the investigations necessary in industry. Medical officers associated with industry must take their share of the work, and all we want to know is what they are doing and, if they want help, to give it to them. Here again, our conference should be of value to all concerned.

Finally, it is clear that in a subject such as we are considering, the development and application of the facts discovered must depend on industry itself, as the research worker is unable to take administrative action of any kind. The application of discoveries therefore requires not only the good will but also the active co-operation and determination of both employers and workmen, to see that the necessary work is carried out under the optimum conditions as discovered by the investigator, and that the health of the workers is maintained at the highest level.

The main task I have today is to review in general the work of the Industrial Health Research Board. This cannot be done adequately in the short time at my disposal, so that I would like to refer you in this connection to an excellent article by Dr. Schilling in the third number of the new journal, the *British Journal of Industrial Medicine*, which is edited by Dr. Hunter [*Brit. J. industr. Med.*, 1944, 1, 145]. That article provides a much more complete survey of the whole situation than I can give today. I want to pick out just a few points, but even these I can deal with only in the briefest manner.

You are all aware that in 1942 the Medical Research Council decided to reconstitute the Industrial Health Research Board, and to include in its terms of reference not only the type of work it had been doing previously, namely discovery of the best conditions for the maintenance of health and efficiency in industry, but also the whole subject of industrial medicine and disease. Some of this work had previously been undertaken by the Medical Research Council themselves. They have, for instance, done a large amount of work on pneumokoniosis, especially in relation to anthracite miners and cotton spinners. They have also made investigations on toxic solvents, and on miners' nystagmus. Under the new arrangements, it was expected that all such problems would come within the advisory capacity of the Board, and that is really what has happened during the past year. One of the first steps taken by the Council after reconstituting the Industrial Health Research Board was to set up a new department of Industrial Medicine at the London Hospital under Dr. Hunter, and he will presently give us an account of his first year's work. He appears to be tackling the whole problem in the most vigorous and successful way, and if he can continue at the same high level and with the same degree of activity, his department will undoubtedly have great influence in developing this aspect of research on industrial hazards.

One of the developments of this war with which you may not be very familiar is the great amount of research that has been directed, largely on the initiative of the Medical Research Council, to the care and efficiency of our fighting men. You read accounts in the newspapers almost every day of important technical discoveries concerning weapons of war, but with this development, weapons have become so complicated that only highly selected and trained men can use them effectively. Clearly, the value of any instrument or weapon can only be determined by the capacity of those using it. In order to meet this state of affairs, personnel research committees have been set up for each of our fighting services. The object has been to study the men in relation to their tasks ; to fit them to the machines, or, sometimes more important, to adjust

the machines to suit the men. This has meant a reversal of the old view that the more uncomfortable a man is, the more efficiently he is likely to do his work. It has become generally, though not entirely recognised, that a man can do a job of work better if he has a feeling of safety and comfort. This research has affected men in all aspects of war, but more particularly in relation to aeroplanes, submarines, armoured fighting vehicles, guns and such like weapons. Many investigations on the psychological side of the problems have been carried out by workers under Professor Bartlett in the Psychological Laboratory at Cambridge. Dr. Craik is one of the outstanding young investigators engaged on this work, and he will give us an account of his researches this afternoon. The Council were so impressed by the importance of this subject in war that they felt it would be equally valuable in peace, especially in industry, and they decided that similar work should continue in normal times. Dr. Craik will tell us how he hopes to develop the same kind of investigations in industry.

It has been realised that knowledge of the sickness incidence of various groups of industrial workers might point to factors in the working environment which needed the attention of industry and of the research worker. The Industrial Health Research Board, therefore, set up a committee to investigate the recording of sickness absence in industry, and their report was published three weeks ago [*Industrial Health Research Board Report No. 85*, H.M.S.O., London]. Another committee is preparing a report to guide industrial concerns in keeping other kinds of records relating to workpeople's health. This may seem a long cry from research, but these records are fundamental to any industrial medical service, and indeed to any research work on the subject. Investigations are constantly being undertaken by the Board into the cause and prevention of sickness absence, and reports will soon be published showing the causes of sickness absence among women working in munition factories. The reports will also contain the views of the workers themselves on their environment, on the lighting, heating and ventilation of their factories, methods of payment, the pace of the work, the arrangements of hours and so forth. Night work is a further important subject to study, since it produces many problems; not only physiological and psychological ones associated with the reversal of the cycle of work, recreation and rest, but also social problems, the main one being that night work upsets the rhythm of community life.

Much work, as yet unpublished, has been done on atmospheric pollution in filling factories, new methods of sampling TNT, comparative efficiencies of dust sampling instruments, and the best method of using overhead heaters in factories. Many investigations have been directed to lighting problems, and the Board are preparing a report covering the work on this subject during the past 25 years. Here is an instance of the vast gulf between discovery and application of results. Practically the whole of industrial health research is directed to the discovery of preventive or prophylactic methods, but these methods are often the last to be adopted, or to become popular with those who have to use them. It seems to require a large amount of propaganda to get even intelligent people to realise that the discovery of a method which *prevents* the development of a disease or a morbid condition is of infinitely greater value than a *cure* of the same condition. The discovery of a curative remedy, such as a pill or an injection, is immediately heralded in every newspaper, and at once becomes of great popular interest. It requires a definite and sustained intellectual effort to persuade people that preventive methods are able to maintain health and to eliminate disease, whereas cures can only affect individuals after they are stricken, and do not usually reduce the incidence of disease. Let us take the case of miners' nystagmus. If it were possible to bring proper lighting to the coalface, it is almost certain that this condition could be eliminated, but if the Medical Research Council announced that they had a

pill which would cure miners' nystagmus, the whole mining community would swoop down and swallow it. Probably the continued production and distribution of the pill would involve greater cost and greater human effort than the provision of proper lighting in the coalmines, and even then might not eliminate miners' nystagmus, but there you are—that is how human nature reacts.

Another type of investigation which is being made on a large scale is directed to the discovery of the incidence of psychoneurosis in industry, and it is hoped that, in the course of the next few months, reports on that problem will be published. Many enquiries are being made into the toxicities of various chemical agents used in industry, some of which, for security reasons, cannot be mentioned at present.

I want to draw your attention to other examples of research directly affecting industry which are being made by the Medical Research Council. I would refer, in particular, to Dr. L. Colebrook's investigations, carried out at first in Glasgow and now in Birmingham, on the treatment of burns. When a full account of this work is published [*Spec. Rep. Ser. Med. Res. Coun., Lond.*, No. 249, H.M.S.O.], you will find it to be of great significance, and you will realise that, because of it, many lives which previously would have been lost can now be saved. The demand for this investigation arose out of the war, but its applications are also important for industry.

Another unit now working in Birmingham is controlled by Professor A. A. Miles of University College Hospital, London; it is enquiring into the place of infection in industrial injury—to see, for instance, whether this actually takes place at the time of injury or at the first dressing or in the hospital. The result, it is hoped will be greatly to reduce the amount of infection following industrial injuries, and thereby to bring about a much more rapid recovery and return to work. One of the points discovered is that infection of wounds by micro-organisms supposed to be non-pathogenic may nevertheless have a large delaying influence on the rate of healing.

At Newcastle-on-Tyne, the Medical Research Council established a unit for research on traumatic shock, with Dr. R. T. Grant as its head. The reaction of the body to injury is the same whether the injury is caused in battle, in air raids or in the factory, as this research on traumatic shock well illustrates. Dr. Grant first started his investigation in London, because of the large number of injuries resulting from air raids in 1940-41. Then, when the air raids decreased, he went to Newcastle, in order to study the same problems in industrial accidents. Later, a time came when the subject assumed such great importance in the army that he put on uniform, took his unit bag and baggage to Italy, and continued the work there on those injured in war. Reports coming from Italy make it apparent that his work has been greatly appreciated.

Those are researches which obviously affect all human beings, but they have a special significance for industry, even if only because there are more industrial workers in this country than any other class of the community and they, as a group, are more liable to injury.

Here I would just refer to the work on penicillin, obviously a priceless drug, of as much use to industrial workers as to anyone else. The Medical Research Council have an active committee working out the clinical uses of penicillin, and also another committee working on the chemistry of this subject.

When the history of this war is written, you will probably agree that the developments in medical and personnel care, especially in relation to treatment of the wounded, must be included among its most significant events. We do not hear much of these things, but the large proportion of wounded to killed in this war, and the high rate of recovery from wounds, have never been approached at any previous time. That is largely due to research work, much of which will

be of permanent help to industry. Again, the development of blood transfusion, in which important advances have been made, will be beneficial to industrial workers. Similarly, the general adoption of improved methods in mass radiography, with a view to finding out the incidence of tuberculosis among workers, will no doubt hasten the disappearance of this disease.

These, then, are some of the activities of the Medical Research Council in their wider aspects which affect industry directly and indirectly. There are many problems still to be solved, but I want to draw your attention to one in particular which still remains to be seriously tackled. There seems to be a good deal of inertia in this country—and even some antagonism—in respect to this problem. I refer to the work of psychologists in endeavouring to fit men and women into their right jobs. However equal men and women may be in the eyes of the law, it is simply stupid to go on considering that most people are mentally and physically capable of doing any kind of work. To continue on these lines means either that many men and women, unfitted for their particular work, will fall out and sink into destitution, or that rules and regulations, and even laws, have to be made to cater for the lowest common denominator of human capacity, at the expense of industrial and other efficiency. While this happens to employees, other social methods are available for sustaining unsuitable employers in their work. We simply cannot afford to allow these drags on industrial efficiency to continue. If it is true that ten per cent. of the adult population of this country have the intelligence of normal children of seven, then we must recognise this fact as it affects employment. It will be necessary to use new methods involving intelligence tests, on which I do not want to lay too much stress, and others, including occupational tests, in order to fit these people into their right jobs from the beginning. We have learned from the army during the war that men of mentally lower grade than the average have their proper place in life ; that they can be suitably employed, and be happy and contented ; and that there is no need for them to be placed in positions for which they are unfitted. Equally important, we must find means of hastening the advancement of able men of any class to suitable positions. This is an aspect of work which is probably more important than any other in relation to industrial health. It is a big problem and will require much endeavour, not only by way of research, but also by trial and demonstration, to convince political and industrial leaders that their opposition to such work is unreasonable, and harmful to progress.

Research work can only be a spearhead, and a spearhead without a shaft—and without somebody to hurl it—is no good whatever. The Industrial Health Research Board was cluttered up with spearheads accumulated between the two wars. They had supplied the facts relating to such questions as rest and hours of work, preselection of workers, avoidance of accidents, ventilation and humidity, lighting and many others. These results were left unnoticed until the war began, but as the war has gone on, their value has become more widely recognised. Such research is now regarded as essential for the development of efficient and healthy industry. But this may be only a war reaction. Two years after the war, we shall probably have forgotten all about these things unless industry itself is prepared to adopt the enlightened point of view. It is up to the people who attend conferences such as this, it is up to employers and workers, it is up to the trade unions, to play their part and see that these spearheads, as I have called them, are not allowed to lie about as litter but are fashioned into effective instruments, and so hurled as to do their job and maintain industry at the highest level of efficiency, and to provide us with healthy and contented workers.

THE WORK OF THE DEPARTMENT FOR RESEARCH IN INDUSTRIAL MEDICINE, LONDON HOSPITAL

Dr. Donald HUNTER (Physician-in-Charge of the Department, and Physician to the London Hospital):—Everybody in this audience knows what a hospital is—that it aims to treat, and if it cannot cure, at least to relieve suffering; and that it also tries to rehabilitate the patient after he has been ill. In order that I may explain to you what my Department is in the London Hospital, it is necessary for you to understand the functions of a teaching hospital. A teaching hospital is part of a university, and is a school for training doctors and nurses. It does much more than that: it has a great national and international responsibility for finding out the exact facts about disease.

Perhaps those of you who are not doctors have very little idea how difficult it often is to be exact in diagnosis. It is one of the greatest aims of hospitals connected with universities to ascertain new facts about disease, and so make diagnosis as certain as possible.

Until June, 1943, there was no complete organisation for research in industrial medicine in this country. It is obvious that the urge to do good work will enable some people to carry out research effectively in a cellar or an old shed, as was the case with Pasteur and Marie Curie. But modern work requires equipment which is complicated, and collaboration with various other departments is necessary. These other departments exist in teaching hospitals, because of their close connection with a university.

The department which the Medical Research Council have endowed in the London Hospital under my directorship is called the Department for Research in Industrial Medicine. It consists of doctors, pathologists, chemists, physicists, technicians, almoners and nurses, and it has access to statisticians. The question of its activities in teaching is vastly important, but, unfortunately, I shall scarcely have time to mention this aspect of the work.

Sir Edward Mellanby has pointed out that industrial poisons make up only a very small part of the story of medicine in industry. Nevertheless, I will begin by mentioning some toxicological problems, to illustrate what a department like that in the London Hospital can do. Let me tell you the story of the manufacture of a very dangerous fungicide, which is dusted on corn crops all over the world to kill a fungus which converts the starch of the wheat grain into a stinking mass of black powder. Science has shown that organic compounds of mercury, diluted to less than 1 per cent. in some inert material, can be dusted on to the seed, thus saving the future crop. It is a principle in toxicology that the chemical structure has something to do with the degree to which the resulting material is poisonous. Agricultural chemists know perfectly well that of the organic compounds of mercury, the one called the methyl derivative is so deadly that they scarcely dare use it in a dust of 0.5 per cent. dilution, for fear lest it should kill the grain itself. Yet it was manufactured, and a man came to the London Hospital who had been poisoned by handling it. Now, although enquiry was made into his occupation, the symptoms were so bizarre that his condition was thought to be a form of major hysteria. It so happened, however, that his mate came to hospital with exactly the same symptoms, which doctors had never seen before, affecting the whole of his nervous system and making it impossible for him to walk straight, or to see anything properly that was not directly in front of him. His vision to the right and left had been destroyed by the effect of this volatile poison on certain parts of the brain.

The problem was investigated by placing rats in an air-tight chamber, so arranged that the only air they could breathe came over a dish which contained methyl mercury iodide. After some time, the rats behaved in a drunken sort

of way, like the men ; and their brain tissues showed changes which corresponded exactly to the symptoms shown by the men. Clearly, toxic substances such as these should be submitted to people equipped to carry out animal experiments : the man should not be the experimental animal. This can now be done ; and I am more than willing, as long as I have staff enough, to test substances which are coming into use in industry, to find out beforehand whether they are likely to hurt the workman.

Now let me tell you the story of dioxan poisoning. You can understand that a volatile poison passing through the lungs and the blood stream may have a selective effect on the kidneys. Thus, a man might have a little pain in his back and pass blood in his urine. When that happens, any practising doctor may consider him to be a case of Bright's disease and treat him in bed. It is by no means invariable for a doctor treating a case of Bright's disease to enquire into a man's occupation. It happened in a factory near Derby that some experiments were being made upon a substance known as dioxan, and there was a young doctor in the Derbyshire Royal Infirmary, who had been trained at my own hospital, and who had to treat a man with pain in the back and blood in the urine. The young doctor diagnosed Bright's disease, but because he had been taught always to enquire into the working environment, he discovered that a fellow workman had the same symptoms. An investigation followed, and dioxan poisoning was put on the map. But supposing neither of these men had gone to the hospital, or supposing the hospital where one of them was admitted had made no enquiry into the man's occupation, both death certificates would have been signed " Bright's disease ", and dioxan poisoning would have been missed.

Then there is the story of an oil that looks like castor oil—tri-ortho-cresyl phosphate. In 1930, in the southern United States, this oil had contaminated a popular alcoholic drink which was flavoured with ginger, with the result that nearly 20,000 people were paralysed in their feet and hands. The illness was called after the drink, Jake or Ginger paralysis. Now many people are admitted to a big hospital in the course of a year, having developed paralysis of the feet or hands. Doctors give the name of polyneuritis to this group of illnesses ; it means simply that many nerves are symmetrically affected. It is obvious that when a doctor on duty in a hospital meets such a case, he should label it " polyneuritis ", and that further investigations should then be made. Lately, some of the young doctors in my own hospital discovered that three men labelled as suffering from " polyneuritis ", and attending various hospital departments, were working in the same chemical factory, where the oil I have just mentioned was being manufactured for use as a plasticizer. It was thus, of course, an easy matter to recognize the industrial origin of a condition previously attributable only to domestic causes.

We have studied conditions in aircraft factories in various places, and our physicists have used exact methods to estimate the concentration of benzene in the atmosphere. We have examined the bloods of the workers, and have correlated these blood pictures with the atmospheric concentration of benzene. We have found that—owing to the insistence of the Factory Department that the content of the dope must not exceed 10 per cent. of benzene—there is not enough toxic material in the atmosphere to do any harm, and the blood counts of workers using spray guns are comparable to those of men and women who are working away from the dope—for example, in offices. In other words, aircraft doping as carried out in this war is harmless to the worker. We are elaborating methods for estimating in the urine and stools the mercury which is excreted by men working in thermometer works. We aim at putting the knowledge of mercury poisoning on the same exact footing as was done for lead between 1920 and 1925 in Harvard. A combination of research workers—

pathologists, physicians, physiologists, and toxicologists—all studied the effects of inhalation of lead dust, discovering the mechanism by which the lead is stored in the skeleton and mobilised in the tissues. We aim at making exact measurements of the distribution of mercury in the tissues and excreta of animals and man.

But there are more problems in industry than those which are purely toxicological. For instance, we are much concerned as to the true nature of an illness which has been labelled "bagassosis". There has been imported into this country for many years a substance called bagasse. It is brought from Louisiana, to be used in the manufacture of fibre board. It is probable that the bagasse in certain cargoes is contaminated with some infective agent, but such an agent has never been identified. Before going on to consider whether any infective agent gets into the lungs of people exposed to bagasse dust, let me outline for you what physicians in teaching hospitals constantly tell students about the approach to patients with chronic chest diseases. Imagine a young woman of twenty-five, sent to hospital with fever and pain in the side of the chest. The young house-surgeon, skilled in diagnosis, makes an examination of the chest, and says that there is an empyema—that is, an abscess between the lung and the chest wall. The treatment for this is a minor operation, to take out a piece of rib and drain the abscess. But, in this case, although the diagnosis of the local condition was exact, the house-surgeon had failed to discover that nine weeks before the present fever came on, while the woman was in robust health, she had choked at a meal and had inhaled a piece of mutton bone into the lung. It follows from this that an essential part of the treatment was to look for the mutton bone with a bronchoscope, to find it and to remove it, because that was the thing which had set up the abscess around the lung. Every medical student is taught this method of approach—namely, that the history of the illness is more important than any other thing about the patient. The young woman in this case died because that golden rule had been broken.

I have taught students for longer than I care to think, but one day a letter came to me from a coroner, asking me to present him with the complete record of a young woman on whom an inquest was to be held. This was a case of asbestosis. The woman had worked in an asbestos factory, inhaling asbestos dust, and her lungs had become scarred and shrunken because of this dust, and she had developed tuberculosis in consequence. When I found my records, the occupation of this woman was stated as housemaid. It gave the story of pain in the chest and cough, of a careful examination of the patient, and a note of the exact areas where I had found lung disease. I had proved by X-rays that there were signs of tuberculosis at the apex of the lung, and I had collected her sputum and proved that tubercle bacilli were present. Although all this was correct, it was not enough. I had broken my own golden rule, by my failure to discover that she had formerly worked in an asbestos factory; the occupational history was incomplete.

So I come back to bagasse. Certain groups of workmen exposed to the dust produced by a crusher and shredder became ill with what we call bronchitis in the bases of both lungs. The condition was confirmed by X-rays; the fever persisted for a week or two, and in most cases the men were perfectly well within six weeks. However, some of the men, after recovery from the febrile illness, were X-rayed at various hospitals, and pictures of their lungs, scarred as by silicosis, were published in medical journals. Unfortunately, the golden rule about medical histories had been broken—these particular men were ex-miners and quarry workers, and the shadows in their lungs had come from previous work in mines and quarries, and were nothing to do with their work on bagasse. Again, the occupational history was incomplete; and bagassosis as at present described in English medical literature is a misnomer.

To turn to other disabilities of physical rather than chemical origin, we have carried out an investigation upon the grinding of duralumin propeller blades with an aluminium oxide abrasive. Although there was so much dust in the atmosphere of the factory that it covered the skin and overalls of the men concerned, X-ray photographs of their lungs showed no disease whatsoever. We have nearly completed an investigation upon the "dead hand" which sometimes occurs in men who use pneumatic tools; we have been able to collect a large number of X-ray pictures of their wrists and elbows, without taking a man off production for more than a few minutes. We are about to undertake an investigation of boiler makers' deafness. It is beyond my comprehension that boiler makers for generations should have been content slowly to go deaf, or that industrialists should have stood by while it happened. Let anybody who is really interested in studying noise in industry put his head inside a boiler when a man is actually using a compressed-air riveting tool inside it! The noise defies description. I imagine that industry would soon get rid of such noises if business reasons necessitated this. My department wants the co-operation of the industrialist in these matters. Think of the gross social disability of boiler makers' deafness. I spoke to one man in a boiler works who never goes to the cinema, nor does his son who is following in the same job, simply because they cannot hear the sound track!

We are working upon a small problem which concerns the refining of precious metals. Certain men have violent asthma if they go into a room where the dust of platinum salts exists: even minute amounts of the dust will produce asthma in some persons. Where dust suppression is ensured by the use of wet processes, no asthma occurs. So much for disabilities of industrial origin. Let us turn now to the placement in industry of the physically unfit. Clearly, the rehabilitation of the disabled is a problem of great social importance. The industrialist is often vexed because the private doctor says that a particular man must have a light job, a statement which usually means very little. Doctors must know more about the work men do in industry. Henry Ford said that there were more jobs in mechanised industry for a man without an arm than for a man with two arms. The rehabilitation of the physically disabled is a vast problem, but we also want to study the question of the employment of the physically unfit, and it is obvious that there are hundreds of jobs which can be done by men with chronic diseases of the heart, lungs, or nervous system. We have interested the cardiac department of the London Hospital in this problem and, with the help also of almoners specially trained in factory work, we are going to undertake a systematic investigation as to what jobs men with valvular disease of the heart can do in factories.

I hope those in industry will support the universities and hospitals without delay, in endowing chairs of industrial medicine. The vast problem of teaching not only the medical undergraduate but also the post-graduate is of fundamental importance, and I hold strong views about the question of training the industrial medical officer. It is all very well to talk about giving him a diploma, but it is very important first to make him a good doctor. It is easy to be a specialist, but by no means so easy to be a good doctor. When the industrialist is cross with the doctor for inaccurate certification, perhaps he does not realise the difficulties and pitfalls which face the practising doctor, and, apart from mere training, it is really astonishing how many qualities go to the making of a good physician. Industry must encourage the universities and teaching hospitals to produce better industrial medical officers. And not only must the medical schools develop a greater awareness of the problems of industry, but also the industrialist must produce better medical services in his factories, thus attracting first-class doctors to the work. The Association of Industrial Medical Officers has succeeded in producing a journal, *The British Journal of Industrial Medicine*, of which I have the honour to be editor, but my

colleagues on the editorial board, and notably Dr. Donald Stewart, do practically all the work for me. This journal has contributed, and we hope will contribute more in the future, to the educational needs of doctors and nurses in industry.

It remains for me to thank those friends and colleagues without whose co-operation, skill and enthusiasm the everyday work of my department would be impossible. They are Dr. K. M. A. Perry, Mr. R. F. Milton, Dr. N. Spoor, Miss H. M. B. Buckell, Mr. J. L. Hoskins, Mr. W. E. Duffield, Miss D. M. Thornton, and Mrs. C. E. Waterman.

DISCUSSION

Dr. R. E. LANE (Industrial Medical Officer, Manchester) said that he had enjoyed this romantic description of a department of industrial medicine, and he wished to underline what Dr. Hunter had said—that they must have more of these departments. It could not be expected that one department in London could investigate all the problems presented by industries such as cotton, mining, and shipbuilding. There must be similar departments in other teaching hospitals.

Dr. M. W. GOLDBLATT (Industrial Medical Officer, Manchester) congratulated Dr. Hunter, and desired to add one or two remarks on toxicological investigation. The industrialist was concerned mainly with the properties of a substance as applicable in his industry. That was his first demand. It was only secondarily, and after long delay, that he usually paid attention to the matter of noxious effects, which should have received attention at the beginning. Hitherto, investigation even of the types of cases which Dr. Hunter had mentioned might be called "post-mortem toxicology". The investigation should take place *before* the human being was exposed to the material. It was very doubtful whether, even with the additional departments that Dr. Lane wanted, this could be carried out except after a very long delay, but, in his view, no firm should be prepared to take into a factory a material of any kind unless with such material there was forthcoming the information as to the health hazards it might involve.

He would recount one example which had recently come to his knowledge. A request was made to a company for a material which was to be used as an accessory factor in a certain manufacture. The industrialist concerned consulted him, and he told him that the material was carcinogenic, and advised the industrialist to refuse to supply the small factory with that material under any conditions whatever. He had no doubt that the small factory owner would go elsewhere and would probably obtain his supplies. To obviate the future possibility of happenings of this kind, the principle enunciated above should be made a national one.

A second point he would emphasise was that in industry innumerable materials of unknown biological properties were liberated upon the public. Often, no indication was given even of the chemical content of the material. He mentioned, as an example, the range of solvents. The industrialist and the worker used these things for years; and then, later on, it was found that the workers were suffering from anaemia or some other condition. This sort of thing should stop; but how to stop it, he must leave to the propagandist efforts of Dr. Hunter and the willing co-operation of industrialists.

Dr. C. L. POTTS (Industrial Medical Officer, Redditch) referred to the possibility of aluminium alloy dust having a deleterious effect on the lungs. Without such an investigation as had been recently carried out by Dr. Hunter, one could only try to forbid the use of the dust; otherwise, it could only be a question of waiting for a number of years to see if it had any harmful effect on the lungs. The work so far carried out indicated that the dust was not harmful in this respect.

Captain H. FAULKNER, R.A.M.C., said that he had a vivid memory of a patient lying in bed at the London Hospital, and of himself—a nervous first-year medical student—being required to relate to his clinical teacher, Dr. Hunter, the history of the case. When it came to the question of the patient's occupation, Dr. Hunter asked "What was the factory like?" That question took him completely by surprise, and he was told that, before the next teaching round, he must go to the factory where that lad was employed, so that he might give an account of the working conditions there. He did so; and he was convinced that he learned more about that particular case in that way than he had ever known before. He learned more about his job as a doctor by such an experience than by attending a number of lectures, and reading text books. He believed that there were large numbers of medical men and women who would have a completely new approach to their job if they could have the necessary instruction in industrial problems, with practical experience and field work, whilst still students.

A vote of thanks was accorded to Sir Edward Mellanby and Dr. Hunter, and the session closed.

**INDUSTRIAL HEALTH RESEARCH FROM THE POINT OF VIEW OF
MANAGEMENT**

CHAIRMAN: E. R. A. MEREWETHER, M.D., M.R.C.P, K.H.P.
(H.M. Senior Medical Inspector of Factories)

The CHAIRMAN said that Lord Forrester needed little introduction. For a number of years, he had done distinguished work in the industrial and social fields, both here in the Metropolis and in the Western Marches. In industry, as Managing Director of the Enfield Cable Works, Ltd., he had been specially concerned with progress and development in a vital industry which had surmounted difficulties almost unprecedented even in this war. New materials had had to be discovered and applied, and new processes developed ; and—as was usually the case—new problems of industrial health had had to be solved.

Research was a hard master and often ungenerous. He was reminded of the great Sir Francis Bacon—a family connection of Lord Forrester—who, over 300 years ago, first placed science on the modern experimental and deductive basis, as opposed to the detached academic outlook or approach. It was credibly asserted that Bacon made the first scientific observations on refrigeration as a method of food preservation ; regrettably, however, he lost his life in this research, because it appeared that he contracted a chill which proved fatal, when he alighted from his coach to stuff a chicken with snow. This was an example of applied research without personal thought or fear. With such thoughts in mind, they looked forward to hearing a constructive, valuable and provocative paper on industrial health research from the point of view of management.

Lord FORRESTER (Managing Director, Enfield Cable Works, Ltd.) :—It is my duty to try to put to you in a short space of time my own view of this great problem of industrial health research, as seen through the eyes of one engaged in management in one particular, industry, only. I want to use the term "Industrial Health" in its widest sense. I am not qualified to speak of the pathology or toxicology of industrial disease, but I have in the past few years tried to give a little thought to the wider application of the findings of research to the development of the industrial environment on the right lines.

I conceive that the fundamental problem before us is the health of the individual in a healthy environment rightly integrated, and then the right integration of the industrial unit, or group of units, with the community to which they belong. I conceive that it is not possible to separate logically one from the other : they are parts of an essential whole. Industry, in the last few years, because we have had virtually full employment, has had very quickly to change its outlook. The White Paper promises us full employment in the future, and I hope that the change that is now happening will continue, and not regress as it did last time. If it does continue, I believe we have the principal requisite to tremendous advance in the development of the relationship between the human being and his working environment. I believe that the kind of research which is really important at the moment is research into management and the teaching of management ; and research into the wider application of the knowledge already won by the scientific groups. That I believe and hope is one of the objectives which the Industrial Health Research Board has before it.

As one engaged in industry who, I believe, is always prepared to try out experiments of many kinds if they are reasonably practical, I should welcome the establishment of many more small younger-minded research teams, working on these practical problems of the application of knowledge. I believe that

such teams—and a number of them was hinted at this morning—are essential ; and I believe that they should have to back them a panel of distinguished people to whom they can turn for consultation and advice. I believe, however, that each such working team must be small, and must be composed both of specialists and representatives at all levels from inside industry. I believe there is a great field for this type of developmental research. And, imagining that such teams might be possible, there are a number of problems which I, as a manager, should like to put to them.

The first is that I feel far more work must be done on the problem of posture in industry. It is not sufficient to look at a process as some of us do now, and then say, "What is the best type of chair to fit it ?" or, "What is the best type of arrangement to provide for the comfort and convenience of the worker ?" I think that in the future we shall have to design our processes, as our tanks and aeroplanes have recently been designed, with the position and comfort of the operator in mind, and not just the purely technical requirements of the process itself.

Personally, I believe in what I call the peripatetic job : I believe that the industrial worker who is "tied to his or her seat" loses something ; I believe that industry has gone perhaps too far in bringing the material to the individual. I should like to have detailed knowledge from many industries as to whether that is so. When I look round—and I visit many factories—I see an astonishing lack of thought going into the ordinary question even of sitting or working position. I am dismayed ; and I want to know where I can obtain in intelligible form the right information. I look at agricultural machinery made in this country and in the United States and I see really excellent well thought-out seating arrangements ; I look at the overhead cranes of industry, doing work just as bumpy, just as uncomfortable, and I see dismal benches fixed in impossible positions, for workers whose jobs are crucial to production and safety.

My second question to put to such a team would be, "Can you, working together with your specialists and your industrial people, devise a better method of keeping industrial health and personnel records ?" I know of the work which has been done in this field ; I have seen the recent work, and I feel it to be inadequate and wrongly based. As I see it, a proper record of the people in industry is essential both to industry and to the country. It must be comparable, it must be complete and it must be simple. There are the essential records of a man or woman which must be accessible to all in the factory who need them, and to the statisticians outside. There is the health side of the record, which must be accessible only to the industrial medical officer or other qualified person connected with the factory ; and, finally, there are the purely labour records, in which the health side may be interested, but not in such detail perhaps ; all must be properly kept. The larger the factory one goes into, the worse the records one often finds, because the system has not been designed in relation to the scale on which it has to operate. There is a great field here, I am certain, for clear-headed co-operative research, which could give a fundamental statistical basis to much of the other work that remains to be done.

My third problem is one where much has already been achieved—that is, the problem of working time, of breaks in working hours, and of the organization of shift work. I believe we are flogging dead horses when we talk of the 40-hour week or 8-hour day, or of any other week or day. I believe that at the least we ought to think in terms of the year. Whether it is a 2,000 hour year, or what it should be, I am not prepared to say, but the spacing and duration of breaks in that year must be vital to health. As an industrialist, nobody has put before me any really coherent information on this point—and it is a very important

one—any more than they have put before me really useful facts, and the experience of others, on the organization of shift work in processing industries. It is a very big problem, and it has its detailed application. I mention one instance, as a person who has lived and worked for many years before the war with the coal-miner. I believe one of the great problems of the coal-mining industry is the question of the collier's mid-shift snack. The collier works a $7\frac{1}{2}$ -hour shift, and he takes with him a meal which his wife has prepared, carrying it in his pocket in a piece of paper. He eats it at some convenient point during the shift, squatting under difficult conditions ; and the conditions under which he eats his meal vary from day to day. He eats with it coal dust, quite apart from the fact that he is often eating the wrong meal for the kind of work he has to do ; and he then continues to work after that meal in cramped conditions, in great heat and dust. He goes up afterwards, and very often nowadays he can get a glass of milk at the top—I do not think that that glass of milk is the answer to the problem. I am quite sure that no real information has been put across as to how this problem should be dealt with, and it is information which must go to the individual workman as well as to the manager.

My fourth problem is a universal one that applies to every factory—the problem of sanitation and hygiene. It is a curious fact that (to the best of my knowledge) the only really worthwhile publications on industrial lavatories were produced by the Nazi Party in 1938. They are excellent—one has to admit it : we have nothing of the same standard in this country. One goes over factories recently built for private concerns or for Ministries, one asks to see the lavatories, one is thought to be a bit curious, one recognises whether the manager is a good one by his willingness to take one there or not ; and when one gets there, one finds, time and again, architectural, engineering and hygienic monstrosities perpetuated in the name of sanitation. It is not a laughing matter, it is a tragic one. The tone of a factory is very often connected with the tone of the lavatory ; the design of the lavatory is vital, but it is almost universally ignored, and the same mistakes are made again and again because of lack of knowledge. We, in our own plant, only a short while ago set out to try to develop a standard building specification to which existing lavatories could economically be altered ; we produced what we feel to be quite a useful document, and we have tried to follow it through, with obvious good results, recognised on all sides. It is then all the more painful when one goes elsewhere and sees the same old mistakes being made in the same old way.

My last point, and the biggest, is the relationship of the physical environment of industry itself with the environment around it. It is a problem where the town planner and the industrialist, and those interested in industrial health research, have got to get together. No one, single-handed, can solve it. Industry very often is represented nowadays either by a smoking chimney or by some florid vista on a by-pass road ; both are obviously wrong. If you go to a factory—for example, the Murex factory—where men got together and thought together about lay-out, materials, services, finishes, design and structure, and put their composite knowledge together with the knowledge of those who wished to run the plant, you will find a completely different solution, 20 or 30 years in front of its time. Yet nowhere can you find the lessons of that solution put across for others to study. It is no longer necessary for industry to deface the surface of the land,—the loss of green sward in any area is a matter vitally linked with the health of people. Experiments in this country and in Germany show what can be done. It is seldom necessary for industry to allow liquid effluent to go unhindered into the rivers ; it is becoming less and less necessary for industry to allow gas and dusts to be let out in bulk into its own environment, and into the environment of those who live around it. It is not necessary for the boiler-maker to be deaf, or for many other problems

connected with noise to occur, if the designer of the process is conscious of the risks he is placing upon others. It is not necessary for the physical appearance of industry to be that of an abomination standing where it should not.

I believe that in all these fields there is tremendous hope if we can act quickly enough and concisely enough, and if we can put our knowledge, such as it is, across to the widest number of people—not only to the managers but also to the men and women in industry, and particularly, in my view, to the shop stewards, because where there are good relationships between manager and shop stewards, you very often have the best and soundest democratic stimuli going to and fro between one and the other.

I should like to see (though I know I should not suggest it) a clean sweep made in this country of industrial propaganda of the wrong kind. I feel that so much of what has been done during this war has been wrong and confusing because it has always been directed towards some particular problem. I should like to see the whole of the Factory Acts and Regulations taken down from the walls and put decently together in an indexed book, which should be available in every factory, large and small, in the proper place for all to consult it; then I should like to put up every month, in every factory, a wall sheet or wall newspaper, decently printed, illustrated with colour, giving in concise form, for the ordinary man to read and understand, the essential knowledge which is now available. That same knowledge I would reprint in the form of a broadsheet which went to every manager. And it would be the Factory Department's job to ensure that that information went out, and that it was put where it could be seen by all.

As analogies, I would refer you to the wall newspaper "The Midnight Watch", issued in connection with A.R.P., and to the equally excellent "Monthly Science News" digest, which is issued, free of charge, by the British Council. The combination of simple, compact, well printed, well produced, well illustrated information of that kind might go far towards stimulating thought and action within industry, which is where the initiative must be; enforcement of these things from outside is unsound, undemocratic and often unpleasant.

I speak without any wish to decry the excellent work that has been done by many departments. Management itself is becoming a science and an art; there is no longer room in industry—least of all in competitive industry—for the bad manager. Unfortunately, the bad manager is always the last person to realise his shortcomings. The only way to get over that, in the system under which we live, is the wider and more intelligent dissemination of information, using the best possible minds grouped together to put it across in simple form, and using the best possible technique of presentation, so that it is pleasant to read and entices one to read it. There is perhaps no more important task in industry today.

DISCUSSION

The CHAIRMAN said that Lord Forrester had given them much to think about and, personally, he would give much thought to what had been said, because there were many new and constructive ideas in his talk, and also a little useful provocation. . . . He was reminded about the need for quick dissemination of practical information, which had already been much thought about and discussed, but for which the right answer had not yet been found. The integration of the various contributions to industrial health which Lord Forrester had stressed was another matter which required not facile comment but very deep thought.

Sir Wilfrid GARRETT (H.M. Chief Inspector of Factories) said that he was deeply interested in what Lord Forrester said about posture in industry, because he had seen the defects throughout his life. Lord Forrester had struck the right note, of course, because machines were not designed for the men who were going to work them. The man who drove his own

motor-car paid for it, and he got the seat he wanted ; but the man who worked a power press did not pay for the press and he did not get the seat he wanted. There was still a long way to go in the designing both of seats and of machines. A Committee had recently been appointed to advise the Factory Department on the design of the best seating arrangements in industry, and Mr. Isaacs was a member of this Committee, but it was clear that there was much work to be done in this field, apart from that one question.

A Factory Inspector rarely got a pat on the back, and the only one he ever received was in an industry using a machine so badly designed that the girl working it could neither sit nor stand upright, and he suggested that a sort of leaning seat should be arranged. A month later, when he revisited the factory, the girls told him what a great thing he had done for them. At any rate, it was a step in the right direction.

Even on the prevention of accidents he had constantly preached that it was wrong to look only at the guard. He maintained that correct safety and posture started at the drawing board, and, there again, the propaganda which Lord Forrester had mentioned was necessary to get the drawing office interested. The milling cutter caused many accidents every year which need not happen, but it was almost impossible to design a guard that would give absolute safety. It should, however, be possible so to re-design this machine that the accidents could not happen and production might even be improved. He therefore warmly supported what Lord Forrester had said about posture and design.

Dr. GOLDBLATT said that he had jotted down a few notes before the meeting, on matters which he hoped to have an opportunity to voice during the conference. He felt that he must, in the process of years, have become infected (he used the word very gently) by the point of view of management, in that so many of the notes he had made corresponded with suggestions made so well and clearly by Lord Forrester. One of his points was that, in his view, management, workers, and machines must somehow integrate into a harmonious unit. In the process of obtaining that unity, the medical officer was frequently involved, and, speaking as a doctor, and in some measure in accordance with the views of doctors with whom he was associated, he had found that the difficulties made by managements in bringing about even a measure of the desirable changes which Lord Forrester had mentioned was sometimes heart-rending. It was not in the mind of managements in the country as a whole that these changes were undesirable or were not necessary, but there were so many accessory forces in operation that perforce these requirements were relegated to a distant background and only as a tenth priority, and even less, would they be implemented.

Lord Forrester had stressed the question of sanitary requirements in a factory. Nothing could be more elementary than that requirement, and yet how many doctors in that room at that moment could say that they had not repeatedly brought this to the attention of managements and failed to obtain any substantial redress or improvement ? What was the reason for this ? He suggested that, in part, it was that managements had forgotten in a large measure that they were, in effect, in control of the worker for 8 or 10 or more hours a day, and that in that period they could educate the men by regulation, by, might he say quite gently, example, in the proper utilisation of these sanitary requirements, which frequently were ill-used. Too often, the electric lamps in the lavatories were stolen, the door knobs unscrewed, and hangers for clothes were removed. In the workers' own homes, conditions were sometimes so bad that when they entered the factory their reaction to a thing like a lavatory was elementary and almost animal-like. He did not, of course, mean to imply that this was the case with all workers, but it was so with very many. At various factories in Manchester there were most excellent lavatories, but until the workers' families had been supplied with electric lamps, these continued to disappear from the lavatories. He felt that this was a sad comment on mental outlook ; and that management must take that as one indication of the sort of teaching the workers often required.

Another point was the dissemination of knowledge. This was useless unless the recipient could appreciate and understand the information. How much of the propaganda during the war had been absorbed by the workers or the managements ? The immense clutter of paper put an intolerable burden on management, and much of it was specialised matter in general terms and not detailed. The manager should realise that the integration of these matters in his factory was part of the process of production. The effect of pamphlets had been most disappointing. In the Industrial Health Research Board, there had been a discussion on the issue of " popular " pamphlets, and the Secretary of the Board would remember that there was a lot of discussion on the form of these pamphlets. The result was that pamphlets were put out which were claimed to be elementary, containing first principles, illustrated by simple diagrams, and to be understandable by all those needing them. They were disseminated in the factories, but discussion with the workmen after a sufficient period had elapsed to enable them to read the pamphlets was a very sad experience. The reactions of the workers showed up the faults of education, the faults of home conditions, the faults of lack of leisure to develop the mind ; and it also showed the fact that the mentality of the people was, as yet, largely undeveloped. Therefore, managements must realise their educational responsibilities, and the need for proper training of personnel directors ; they must " stick at it ", in order to attain what he understood as, and what he hoped would be, industrial unity.

INDUSTRIAL HEALTH RESEARCH FROM THE POINT OF VIEW OF THE TRADES UNIONS

CHAIRMAN: Mr. J. L. SMYTH, *Secretary, Social Insurance Department, Trades Union Congress*

The CHAIRMAN said that a good many of the difficulties in industry were a legacy of what was called the industrial revolution. If Lord Forrester's opinions could be regarded as an example of the development going on on the management side of industry, then it looked as if another kind of industrial revolution was taking place—a revolution which was very welcome and which would bring splendid results in due course.

Mr. Isaacs, who was to give the next address, was a Member of Parliament, General Secretary of the National Society of Operative Printers and Assistants, President of the Printing and Kindred Trades Federation, Chairman of the Workmen's Compensation and Factories Committee of the Trades Union Congress and a member of a Royal Commission on Workmen's Compensation, so that he knew a great deal about industrial health. He had put his principles into operation, by the foundation of a magnificent establishment in the Midlands, called the Natsopa Memorial Home, the object of which was to help the members of the Union to recover their health and vigour. The conception of the home, its foundation, and its continued success were due almost entirely to the imagination, drive and enthusiasm of Mr. Isaacs. He was already an elder statesman of the Trades Union Congress—perhaps it would not be long before he was the eldest statesman—and in that important position, and as Chairman of the Workmen's Compensation Committee, he could speak with knowledge and authority.

Mr. G. A. ISAACS :—The question of industrial health is of particular interest to trade unionists. Over a long period of years, we have given the matter very careful study. Improved working conditions have been obtained by direct trade union action, through the Factory Acts and various other laws and regulations.

Ventilation, lighting, proper arrangement of work benches, seating, the provision of canteens, and the general atmosphere of the work place are all important in the preservation of health. Fitting the worker to the job is also a matter of supreme importance, and that applies, of course, not only to the people at the bench but to those in the board room and offices as well. Success in this aim would go far to reduce accidents.

New processes in industry are constantly giving rise to new health problems. In addition, the stress and strain caused by mechanisation, monotony, dust and fumes, and other factors, have to be contended with. The prevention of ill-health has always been the aim of the trade union movement.

We press for the scheduling of industrial diseases, and for the payment of compensation so that people may be properly cared for when they are affected ; but this in itself only draws attention to the cause of the illness. Our real aim is prevention. The development of effective preventive measures must depend on research and, therefore, the trade unions have always regarded it as very important that research in industrial health matters should be expanded. There has hitherto been difficulty in getting the necessary data, because of the lack of organisation in our health services as a whole. This, it is hoped, will be remedied under the new national health proposals.

The diseases scheduled by the Act of 1906 (in the Third Schedule) were as follows :—Anthrax, Lead, Mercury, Phosphorus and Arsenic poisoning, and Ankylostomiasis.

In 1906, the Home Secretary appointed a Committee to enquire and report : “ What diseases and injuries other than injuries by accident, are due to industrial occupations, *are distinguishable as such*, and can properly be added to the diseases enumerated in the Third Schedule of the Workmen’s Compensation Bill, 1906.”

Note the importance of the words “ distinguishable as such.”

The first Industrial Diseases Committee, in a subsequent report, explained the tests that they applied, which were as follows :—

- (i) Is it outside the category of accidents and diseases already covered by the Act ?
- (ii) Does it incapacitate from work for a period of more than one week ?
(At that time one week was the minimum period of incapacity to qualify for compensation ; the period is now three days).
- (iii) Is it so specific to the employment that the causation of the disease or injury by the employment can be established in individual cases ?

The third test it will be noticed relates to the reference to “ distinguishable as such ” and this obviously caused the Committee some difficulty. The following is extracted from their report :—

“ Bronchitis, for example, is a trade disease among flax-workers ; a larger proportion of that class suffer from it than of other people ; but it is not specific to the employment, for numbers of persons who are not flax-workers contract it also. Unless there is some symptom which differentiates the bronchitis due to dust from the ordinary type, it is clearly impracticable to include it as a subject of compensation ; for no one can tell, in any individual case, whether the flax-worker with bronchitis was one of the hundreds of persons in the town whose bronchitis had no connection with dust irritation, or whether he was one of the additional tens or scores of persons whose illness was due to that cause. *To ask a court of law to decide would be to lay upon it an impossible task.*”

It probably would be an impossible point for a court of law to decide, but it is just the proper kind of problem to submit to research. This is one of the things we want from research—a prompt, accurate, scientific decision, and not an arguable expression of opinion from a court of law.

In 1930, a Home Office Departmental Committee was set up to report as to whether poisoning by turpentine, and papilloma occurring in workers liable to mule spinners’ cancer, should be included in the Schedule of Industrial Diseases ; and to report on any other proposal for extending or modifying the schedule which might be referred to them by the Home Secretary.

The General Council of the Trades Union Congress pressed for the inclusion of the following in the Schedule of Industrial Diseases :—

Poisoning by sulphuretted hydrogen gas, and its sequelae.

The sequelae of pneumonia, and mental and muscular impairment, from carbon monoxide poisoning.

Injuries to the muscles, joints and bones from the use of pneumatic tools and rapidly vibrating machinery.

Undulant fever and its sequelae.

Such great importance among workers was attached to this question of industrial disease that conferences were called by the T.U.C. in many districts. In some cases, so great was the demand for attendance that second conferences had to be held. These conferences showed the worry to workers by injury to their health in various industries.

The disturbing effect on health through the vibration of pneumatic tools was specially investigated by Dr. C. P. Crowden, Lecturer in Industrial Physiology at the London School of Hygiene. Dr. Crowden expressed his pleasure at the reception and co-operation given to him by the workmen concerned. We also had the great advantage of the services of the late Sir Thomas Legge, who, after being the first Medical Inspector of Factories, joined the staff of the T.U.C. and did invaluable work.

Industrial workers will willingly respond to any request for this co-operation with those entrusted with research into industrial diseases.

Delegates to our annual Trades Union Congress have continually raised and pressed questions relating to incapacity arising out of employment.

Many of these maladies are now in the Schedule of Industrial Diseases.

Spirochaetal jaundice is a recent instance of our efforts. The Trades Union Congress had been gathering evidence on this disease for a number of years. The disease, which is the result of rat infection, chiefly affects sewer workers, especially rebuilders or repairers or brick cleaners ; rat catchers, especially of sewer rats ; riverside and water workers ; canal workers and miners, especially in "wet" mines with rats. We first asked for this disease to be scheduled in 1928. We continued to collect evidence, and the results of our investigation were submitted to the Home Secretary by letter in February 1935, again pressing for inclusion of the disease in the Schedule of Industrial Diseases. In July, the Home Secretary stated that the question had been referred to the Departmental Committee on Workmen's Compensation for Industrial Diseases. Continuously and consistently the matter was pressed, but it was not until April 1st 1940 that this disease was added to the Schedule. Five years' delay spent in investigating, talking, patching up sufferers—whereas possibly five months' research would have settled the question !

It must not be assumed I am making any complaint about the activities of the Home Office or what is now the Factory Department of the Ministry of Labour. They take meticulous care that a disease is proper for inclusion in the Schedule. They have often acted in cases where the Trades Union Congress had very little information. My complaint is that these Government Departments had not had at their disposal the complete research service which the Trade Unions consider essential.

Dust and fumes in industry offer a fruitful field of research. Almost all dusts which have been investigated have been found harmful, and it is a reasonable assumption that others may be so. Our members continue to assert that their health is affected by dusts not at present considered harmful ; and research which followed similar assertions in the past has proved the workers to be right.

The long and vexatious struggle to get the deadly and widespread character of silica dust recognised has at last met with a good deal of success, but, even now, we feel strongly that a considerable amount of research into the incidence and effects of this dust is still necessary.

Coal dust—at long last—is now recognised as a cause of incapacity, but the schedule at present gives the so-called "benefit" of so-called "compensation" only to those who inhale the dust in coal mines. It is the same dust as that in which the coal trimmers on ships or in underground stoke-holds have to work, but they are not included. Research should tell us if there is a scientific justification for this variation.

The new powers given to the Home Secretary to include any dusts under the comprehensive title of "Pneumokoniosis" (which, by the way, we have been advocating for over ten years) can be helped very much by research. For example, men working in iron foundries are not supposed to be affected by dust,

but they say most definitely that they are affected ; and their record of ill health strongly supports their assertion. The same is said about abrasives which are supposed to substitute the known danger of sandstone. Surely research should settle these matters without delay ? There is dust in practically every industry, and they all need investigating.

There has been constant agitation for many years about the risk in welding, and there should have been thorough research into the whole subject long ago. The war, of course, has brought about a great increase in welding, and we are looking to research to safeguard those employed in the process. The Factories Act provides for ventilation, but we feel that a good deal more is needed—and, for that, we look to the research worker to tell us what is wrong.

Dermatitis has been the subject of more action in recent years. Is this because it is in fact on the increase, or is it because approved societies now advise sufferers to seek compensation when there is any suspicion that the condition may be caused by industry ?

Why should printers using printing ink show a greater number of dermatitis sufferers than there is found among the workers making that ink ?

Why should workers using chromium suffer from a disease that develops injury to the nose ?

“ Phossy jaw ” was a scourge not many years ago among match makers. It took a strike to draw attention to this terrible disease, and then research came in and “ Phossy jaw ” went out.

A recent report of the British Medical Association is worth studying—“ The Report of the Committee on Industrial Health in Factories.” It sets out in a sentence what Trade Unions have urged for generations :

“ When a worker takes up employment in a factory he has a right to expect that adequate precautions will be taken to safeguard his health, his safety and his welfare.”

If we delete the words “ in a factory ” and make that sentence to apply to any “ employment ”, that will be right in line with the T.U. attitude. I think that is what the Committee meant, i.e. that “ a worker ”, should include those in mines, shops, railroads, road transport, docks, farms and domestic service.

That Report tells of the almost complete disappearance of lead poisoning. It states that firms with medical service available (that is, curing, not preventing) showed an appreciable lowering of the sickness rates due to sepsis. Reference is made in this B.M.A. Report to the “ Care of Mental Health of Workers.” Trade Unions often enquire what effect upon the minds and nerves of workers is caused by noise, monotony, smells, atmosphere, light, fumes, fatigue, and above all, by the knowledge that the work has a risk of industrial disease. Research can tell us.

The B.M.A. Report also indicates, under the heading “ general working conditions ”, the following as among the most important : “ sanitation, ventilation, heating, lighting, feeding arrangements, hours of work, seating, timing of breaks and rest pauses, transport facilities, distance from work and methods of payment.”

That Report recommends the “ study of specific occupational hazards and the *preventive measures* necessary for their control ”. The Trade Unions claim that if these hazards are shown by research to be beyond control, then their use should be legally prevented.

Why do the Trade Unions want research into industrial hazards ? Again let me quote from the valuable B.M.A. Report.

“ Metal grinders, for example, show a significant excess of deaths from respiratory tuberculosis, bronchitis and pneumonia, chronic interstitial pneumonia and myocardial disease.”

" Certain textile workers show significant high rates from nephritis, cerebral haemorrhage and heart disease."

" Strippers and grinders exposed to the dusty conditions of the card room show probably significant excess in valvular and myocardial disease, cerebral haemorrhage, bronchitis, nephritis, insanity, suicide and diabetes."

Many of the maladies I have mentioned are now included in the forty-three listed in the Schedule of Industrial Diseases ; that is to say, they are recognised as causing incapacity. But we want more than recognition and compensation : we want eradication.

Research is essential, and not merely because the dangerous diseases will be found, scheduled, compensated for—and, we hope, remedied or eradicated—but also because the research may be able to satisfy many workers that their fears and apprehensions are unfounded, so that they may safely continue to make use of certain materials or suspected processes, without risk to their health.

Research will benefit industry as well as the worker. Poor health means poor production, and the community in the long run suffers, for low production often means higher prices. Research, in preventing industrial illness, will remove many of the causes of litigation, with the accompanying cost of doctors, lawyers, and compensation when it is obtained ; this again, will lower the cost to industry and remove the bad feeling often engendered—for the employer gets the bad name for legal actions and their inevitable delay, when the real culprit is often an insurance company.

We are strongly of opinion that industrial health research requires adequate staff and equipment, including premises and accommodation of a standard in keeping with the very great importance of the subject. It is, in our view, essential that the workers engaged in research should not work in isolation, but should have an opportunity of frequent and regular consultation with each other. That exchange of experience and ideas will be a source of inspiration and encouragement to the staff. There should be ample money available for research, and if the work is well done, without stint and without restraint, it will pay for itself many times over, through the increased well-being and efficiency of the people.

Conveyance of the results of research without delay to all concerned is also a matter of supreme importance. In the past, the reports of the Industrial Health Research Board have not received the attention they deserved. This was probably due to the fact that whilst the reports were very valuable, they were most useful to experts and technicians who were able to understand them, but were lost to the great bulk of the people. A good step forward in remedying this has been taken by the production of the popular pamphlets recently issued by the Board ; these have proved very useful, by reducing to everyday language the highly technical reports for the benefit of those who have the most to gain by them.

The trade unions urge, therefore, the provision of first-class staff, equipment and premises for industrial health research on the widest possible scale ; and that the practical results of such research should be transmitted at the earliest possible moment to industry and commerce—the aim all the time being the preservation of the people's health, both mental and physical, thus securing not only their happiness but also their efficiency in the highest degree in the nation's service.

The division of research work may be important. For example, it is often necessary that there should be short-term research, to enable immediate action to be taken for the protection of workers ; and there is long term research, which may necessarily take a long time to establish not only the factors causing

or likely to cause illness but also their nature and relation to other factors. The Factory Department of the Ministry of Labour are necessarily very much involved in all this business, and they have the duty of taking whatever measures are necessary for the protection of workers. The Industrial Health Research Board is, of course, intimately concerned with detailed research, and no doubt these two bodies have a perfect understanding about their respective functions.

We in industry certainly consider both short-term and long-term research to be important.

Research will cost money, but less than the cost of no research. Research has been freely called upon in our war effort, to take lives ; we want it to save lives. Scientists in large numbers (the so-called "back-room boys") have solved new ways to kill Germans ; we want them in future to kill "germs" and save "men".

Research can pave the way to some of those Freedoms expounded by the Prime Minister and President Roosevelt. It can give freedom from fear, freedom from want, freedom from suffering, and, above all, it will pay the nation and help industry.

Nothing—neither money nor enforced leisure—can compensate a worker for ill-health, especially when due to his employment. Few can provide by insurance for an income in sickness that will produce an income equal to the normal wage ; and sickness usually means that more money is needed than when health is good.

By all means, link up the general practitioner with this work of research. The B.M.A. Report urges "the organisation of collective research by general practitioners on the relationship of industry and disease". The Trades Union Congress has submitted to the Royal College of Physicians, recommendations for a special course of training in industrial medicine for works doctors in particular, and for all doctors in general medical practice. Link up those who find the cause and those who treat the effect. The general practitioner may be able to save a man's soul by removing worry as well as curing his bodily illness ; he will enrich his own life by the satisfaction to his conscience that he can do this because of scientific knowledge, instead of just patching up his patient.

The doctor has seen the sick man in his home, he has seen the worry of the wife, he knows of the anxiety of both for the future welfare of their children. With adequate training in industrial maladies, with the essential service that only ample research can give them, those who have the high duty of caring for the bodily and mental welfare of the great industrial population of our country can make Britain not only a land where want and worry is reduced, but also one wealthy in the sense envisaged by John Ruskin who, in "Unto this Last", wrote—

"That the final outcome and consummation of all wealth is in the producing of as many as possible full-breathed, bright-eyed and happy-hearted human creatures."

DISCUSSION

Mr. L. WHITE, speaking as a representative of Shop Stewards, said that a remark had been made during the morning session which suggested that, particularly among work-people, there was a lack of interest in the question of prevention of industrial diseases, and that interest was displayed more in relation to cures. He would disagree with that remark. It was the fact that workers themselves were very interested in the diseases which they contracted as a result of their work ; and they would take every opportunity of co-operating in the discovery of why they got these diseases, and how to prevent them.

Quite obviously, among workpeople there was a great lack of knowledge about these things, but many managements could testify that shop stewards particularly had been very active on questions of ventilation, sanitation, and the various complaints in the factories. Unfortunately, it was not always possible to get adequate authoritative information to substantiate their views as to the causes of certain diseases, and consequently to obtain some remedy for the particular conditions. It had been mentioned that boilermakers went on, generation after generation, being stone deaf. It could not be because they were disinterested. Were they in a position to devise, and operate, means of preventing deafness? We would be disconcerted to say the least, if they refused to work in that industry until something was done to prevent such deafness. The difficulty was to get something done when the workers were keen to take the matter up with a view to finding a remedy.

He was very interested in what Lord Forrester said on the question of devising improved means of disseminating information to employers and employees. This was very necessary. The Industrial Health Research Board had a great task in front of it, an urgent task. He thought all would agree with the proposals outlined by the speakers as to what should be done. The problem seemed to be how the capacity of the Research Board could be expanded in order to enable it to work quickly, to cover the whole sphere of work before it, and to have its recommendations implemented.

Information regarding the work of the Board should be made more widely available; hundreds and thousands of workers had never heard of it. If they had known about it, they would have given information and all the help they could in tackling, on a scientific basis, the questions which they themselves were trying to tackle in the factories. If employers and managements had this information, they might lend a readier ear to the workpeople when the latter made representations in connection with such problems.

He assured the Conference that there need be no concern as to the response forthcoming from workers and shop stewards. He spoke from his experience in the engineering industry, and was convinced that there would be one hundred per cent. response to appeals for co-operation in the work of the Industrial Health Research Board.

Mrs. Y. KAPP (Research Officer, Amalgamated Engineering Union) said that interest on the part of the workers was present and had been shown. The A.E.U. had undertaken an enquiry into health and welfare conditions throughout the Union.

Over 1,660 returns had come in, with some 2,500 individual shop stewards' signatures, and 15 or more other unions had been drawn into answering the questionnaire, which was a long one with 160 questions.

This response demonstrated the interest of the workers, and refuted the remarks of an earlier speaker, on the ignorance and lack of intelligence of the workers. Not only their interest, but their thirst for knowledge, and, in particular, the widespread demand for research, came out clearly in the answers. Two-thirds of them wanted further research undertaken. A large number asked for research into the design and layout of machinery, from the point of view of providing maximum safety and comfort. A number asked for enquiries to be made into the possible harmful effects of solvents used in the manufacture of aircraft; others wanted standards of lighting for precision workers looked into. They also asked for the question of fatigue to be considered, and for recommendations as to suitable hours of work and rest intervals.

These were some of the points which had emerged. The enquiry covered all manner of health and welfare conditions, and showed that a large number of joint production committees did discuss health questions. In many cases, health sub-committees had been set up.

She wished to endorse the point made by Dr. Hunter, that research must keep pace with industrial developments, and the physiological effects of new materials and processes be tested in the pre-production stage.

They wanted to see a national industrial health service which sought to improve conditions all the time. As Mr. Isaacs had said, it must be a preventive service, and this required that factory doctors should be in the closest touch with, and constantly stimulating, research; and the results must not only be made known but used.

A far wider knowledge of the physiological effects of industrial processes should be made available to workers. New industrial techniques produced an intensification of attention, or other changes in the emphasis of effort, and such matters had a direct bearing on the conditions and hours of work, as to which the workers should be informed, in order to formulate their demands for the best conditions for production.

Her last point was the necessity for research workers to consult with Trade Union representatives. All along the line, the medical research authorities should be in touch with the Executives of the Unions; but, apart from that, there was the question of the workers in the field, who should contact the District officials and, through them, the shop stewards in the factories. If these representatives were consulted, the great interest of the Trade Unions would be tapped and their co-operation won. With the whole weight of the organised workers behind it, industrial health research would really get moving.

Dr. Douglas McCLEAN (Association of Scientific Workers) said that it had been agreed by speaker after speaker that more research was required, and they were told that it was absolutely necessary to have adequate records. Dr. Hunter had emphasised the need for the careful taking of case histories, but it seemed to the speaker that all industrial health research must operate in a vacuum, in the absence of a properly organised national industrial medical service. At the present moment, it was quite true to say that less than 25 per cent. of workers in this country had a medical service to look after them at their place of work. Apart from the countless small factories, there were transport undertakings, building undertakings, docks and railways which had no organised medical services in the field. Those industrial medical officers that did exist were employed by the employers ; and the employer, therefore, had in reserve the right of " hiring and firing ", so that most of the workers were not likely to have the complete trust in the medical service that they should have. In his view, and in the view of the Association he represented, it was absolutely essential that there should not be any question of divided loyalties so far as it affected industrial medical officers. It was a curious fact that in the Government White Paper on a national health service the whole question of an industrial health service was omitted ; in the Goodenough Report on medical education, the question of industrial health was dismissed in one sentence, in which it was said that it was a matter for discussion whether postgraduate tuition in industrial health should be obligatory or compulsory in the public health course. It was essential to have, as a background of research, an adequate medical service which would supply the information required. To that end, his Association had tabled a motion at the forthcoming Trade Union Congress, asking the Council to do everything in its power to get a national industrial medical service set up.

Dr. Sibyl HORNER (H.M. Medical Inspector of Factories) thanked Mr. Isaacs for his suggestions for industrial research. It was a very full programme which had been outlined. From her experience in industrial medicine, she would like to pay a warm tribute to the men and women in industry, who gave ungrudgingly of their experience in material facts relating to their work, and to their health reactions. She had never found that workers resented such enquiries, and both men and women came forward readily for such ordeals as blood examinations. The organisation of shop stewards had much to commend it, and when recently she was investigating the cause of dermatitis in a factory, it was a shop steward who marshalled the facts and the workers for examination. This shop steward eventually took part in the discussions with the management, and there was the best of feeling on both sides.

Dr. J. C. BRIDGE (late H.M. Senior Medical Inspector of Factories) said how much he had appreciated Mr. Isaacs' address. He agreed with almost every word Mr. Isaacs had said, and he would add that medical officers in industry, and their Association, were endeavouring to take steps to see that a national industrial medical service should be set up.

Dr. Joan McMICHAEL (Industrial Medical Officer, Perivale) wished to make one or two points bearing on matters discussed, particularly in relation to the development of health education within the factory, and to the co-operation she had received on all health questions. She had received considerable assistance in the presentation of health material, from the representatives of the people who were going to read it. This had been done through the co-operation of shop stewards on a small Health Publicity Sub-Committee. There had been much constructive criticism and many suggestions, which had enabled her to prepare Health Hints in such a way that they would be clear to the people for whom they were intended.

In this way, she had been able to carry out a considerable amount of health education on different subjects, such as rheumatism, influenza, anaemia, nervous debility, etc.; and the workers themselves had asked for posters on such subjects as spitting and its ill effects. This had been handled largely from the point of view of the cleaners, and it provided a good example of the way in which we often needed a new angle of presentation ; a similar angle of approach might be used to the problem of lavatories raised by a previous speaker.

In addition, the Committee ran a Health Library, which had proved quite popular, and considerable numbers of books and pamphlets on health, including those produced by the Industrial Health Research Board, had been loaned or sold. There was also active participation by the workers in such campaigns as that on mass radiography. At a mass meeting on this question, which took the form of a Brains Trust, Lord Dawson, who had been taking part, remarked afterwards that he had never heard so many intelligent questions asked in such a short space of time.

Quite recently there had been an article in the " News Chronicle " on the subject of " half-alive girls " in factories. This was discussed by the full Health Committee at their last meeting, and a number of useful suggestions were made. She would like to ask whether Dr. Goldblatt, in his attempts to get the reaction of the workers to health matters, had approached them as an individual and an expert, or in a free and open discussion round the table. If he had done the latter, he would probably have found a much higher degree of co-operation, and of appreciation of the work that had been done.

Dr. GOLDBLATT (on the invitation of the Chairman) said that his remarks did not relate to all workers, far from it ; but the response had been disappointing. He was afraid that the high standard of discussions which had been mentioned took place in factories in some heavenly region with which he was not acquainted ! Perhaps they were war factories under the administration of the Ministry of Supply, but he was unrepentant and thought many of his medical colleagues would join with him when he said the response was poor, and far from what they had ventured to expect. But he hoped one day to get all the things referred to by Lord Forrester and Mr. Isaacs, and in the meantime he would struggle on.

Dr. T. O. GARLAND (Assistant County Medical Officer of Health Middlesex), said that for the last ten months he had been concerned with a mass X-ray unit operating in Middlesex, and it was pertinent to say that the strongest response was in factories where the workers' organisation was strong. One of the first factories which he visited had no shop stewards and no trade unionism. He asked the managing director if he could meet representatives of the workers ; the managing director had replied that that was not possible, but that if he told his workers that it was good for them to be X-rayed, they would all come ; nevertheless, the response was not particularly encouraging. At another factory, where the general manager gave the opportunity for a member of the Unit's staff to address the workers, it was arranged for the final speech to be made by the convenor of shop stewards, and no less than 90 per cent. of the workers came forward for examination.

THE WORK OF THE UNIT FOR APPLIED PSYCHOLOGY AT CAMBRIDGE UNIVERSITY*

CHAIRMAN: Professor F. C. BARTLETT, C.B.E., F.R.S.

Dr. K. J. W. CRAIK (Director of the Unit) :—The Medical Research Council Unit for Applied Psychology consists at present of eleven research workers who had previously been carrying out investigations in the Psychological Laboratory, Cambridge, principally on problems arising from the war, under the direction of Professor Bartlett ; Professor Bartlett continues to have general supervision of the Unit. Of the eleven workers, six are graduates in psychology, natural sciences or both, four in medicine and one in physiology.

Until the end of the war, it is likely that work of the type now in hand will continue. This has necessarily involved problems largely of an *ad hoc* character, undertaken in response to requests from Service departments ; but certain common principles have emerged, which may assist in guiding a fruitful approach to future and peace-time problems. These principles are that of suiting the job to the man, of suiting the man to the job, and of improving the man's performance.

The first involves mainly the design of instruments, machinery, lay-out and illumination of maps, panels, etc. These problems may be broadly divided into those of *display* and *control*. The first term is that used by Service scientific departments to cover the methods by which information is laid visually before any operator, whether on a map, a graph, a cathode-ray tube or an instrument panel. Often the best type of display is a compromise, e.g. between an instrument-panel so complex that its interpretation is slow or so simple that it gives insufficient information, or (in the case of a night-fighter aircraft panel) so brightly lit that it dazzles the pilot, or so dim that it cannot be read. Psychological experiments, employing laboratory simulations of the real conditions, often enable the optimum type of display to be decided. Even when an optimum does not exist, a graph of the relation between, say, the distance of a plotter from a map and his accuracy in reading grid references will show a very steep rise in error beyond a certain point, and thus indicate a definite practical limit to the viewing distance, as in certain work by Dr. H. N. Mackworth. There should be a great deal of scope for such work in peace-time

* A similar paper has been published in *Nature, Lond.*, 14th October, 1944.

industrial design, especially in ensuring easier operation and preventing accidents, e.g. in instrument panels, indicators, information charts and graphs. General principles have emerged which narrow the field for *ad hoc* experiments. Exact methods of scoring efficiency in war-tasks such as watch-keeping, of a boring but responsible nature, have shown ways of determining optimal spells of work. The effect of discomfort, fatigue and noise on such tasks is also being studied. These techniques for the measurement of human abilities may eventually provide useful ways of assessing the progress of patients recovering from physical or mental illness, and perhaps may also test innovations introduced by researches in preventive medicine.

On the motor side, the positions, forces and gear-ratios of handles and levers on guns and machine-tools are usually compromises between the factors of speed and precision of operation, of simplicity and mechanical perfection or of psychological and physiological suitability. Here again, particular cases are being dealt with by laboratory simulations with exact scoring of performance, and interesting principles of muscular action and sensory-motor co-ordination are emerging. These studies verge on physiology and preventive medicine.

Similar problems arise in industrial design (such as the handwheels on a machine-tool, the stage at which servo-motor or remote control becomes necessary, and the most suitable form for such control), while general principles of use to designers in less important cases could be formulated.

Any human act can be regarded as the result of a sensory-mental-motor chain of events, and hitherto members of the Unit who have worked on the above problems have concentrated rather on the sensory and motor ends of this chain, partly because of their individual aptitudes but also, perhaps, because these are the most fruitful sites for instrumental modification. There is probably, however, an interesting future field in the analysis of the factors that make a task intellectually difficult and have led industrialists to division of labour, with its advantages of increased output and its disadvantages of boredom and discontent.

This approach—suiting the job to the man—should, we feel, be explored to the full, since it puts the industrial jobs necessary for improved standards of living within the power of the majority, whereas psychological selection alone, especially when the job has been made unnecessarily difficult, may result in a high rate of rejection and unemployment. There is, however, need for *allocation* of the available workers, so that they are given tasks for which they are suited ; and for some selection where a task is unavoidably difficult.

This second approach—suiting the man to the job—is principally being tackled by a team under Dr. Alice Heim. They are members of the Unit, but are working on behalf of the Industrial Health Research Board of the Medical Research Council. They have devised a battery of tests and standardised it on a large number of entrants to factories and Government training centres, and some University undergraduates, and are obtaining follow-ups on the industrial subjects. This battery contains a paper test (*AH4*) consisting of a verbal and arithmetical, and a visual part based on relations of identity and opposition, analogy completing series, and following instructions ; a mechanical ability test, an inspection test consisting of metal blocks containing small defects, performance being scored on an accuracy index, speed also being recorded ; some other performance tests resembling factory gauging and assembly tasks, and the National Institute of Industrial Psychology Form Relations test. The emphasis of such work must necessarily be on individual differences in ability, rather than on the features of a task which make it difficult to everyone. Research is being carried out on consistency and validity of test results and of assessments, and on the relation between these two criteria.

The extent to which the value of a test depends on its degree of analogousness, and the distinction between differences of *grade* and *type* of ability, are also being studied.

Certain members of the Unit are investigating night vision and other tests, from the point of view of selection, and of diagnosing vitamin-deficiency and disease. It is hoped that there will also be some time for fundamental work on the special senses. Mr. E. Farmer has begun a study of the capacities of blinded officers, with a view to their obtaining suitable employment. Others are using methods which link almost equally with both of the two main approaches discussed above. For instance, Miss M. D. Vernon is working on visual form perception and memory, with a view both to lay-out of visual tasks and the allocation of personnel; and Dr. D. R. Davis, on the sensory motor co-ordination and responses of temperamentally different types of people in controlling machinery.

The third main approach is to improve the performance of the man, either by nutritional means or by mental and physical training. This, again, involves exactly controlled experimental tests of sensory and motor efficiency, and scoring of performance. Various synthetic training devices have also been produced for Service use. Similar devices may well have a peace-time application, e.g. to motor-driving or machine-tool operation, where the novice is apt to injure either himself or the machine and to gain little insight into what he is doing wrong. Synthetic training equipment with exact scoring devices can assist here; but psychological experiments should always be undertaken to see whether any given trainer is in fact saving training time and improving performance, and whether it would do so equally well if it were simplified, or very much better if it were slightly complicated.

All these lines of approach involve much statistical work—for example, to establish the significance of the optimum values found for some feature of instrument design and to reveal the consistency or inconsistency of an allocation test, and its validity as judged by follow-up evidence. Though most of the members do the simpler statistical treatment of their own results, Mr. E. G. Chambers and Mr. J. W. Whitfield help in applying more complicated methods, and in the development of new ones. Mr. Whitfield is also instituting a new type of recording system in a group of coal mines and two factories, with a view to tracing causes of absenteeism, sickness and accidents. Such investigations indicate where there is a definite field for experimental research into improved equipment, or for re-allocation or retraining of accident-prone workers.

It is hoped that there will be close contact with other bodies undertaking similar work—for instance the National Institute of Industrial Psychology—and with personnel managers, safety-officers and medical officers in factories. While the Unit will always be very glad to hear of any problems which appear to come within its scope, it must be emphasized that it is primarily a research body and has not the personnel or time available for investigations of purely specific and local interest. Thus Dr. Heim has introduced, in several factories for which she has worked, a scheme by which members of her team inspect the problem and decide what existing test would seem appropriate, or develop new ones if necessary; the firm then provides a suitable person who is trained for a fortnight or so at Cambridge and returns to the firm to give the tests and forward the results at intervals to Cambridge. Similarly, it will be impossible to take on a large number of particular problems in display or control design; but wherever a problem of wide interest arises—or one involving test-methods which could be applied as a routine elsewhere when once they have been developed—the Unit is very anxious to be of assistance to any firm which raises it; and it is hoped that similar work may continue for the Services in regard to

their more fundamental problems. The essential thing is that the scientific abilities of the members for basic research which ought, sooner or later, to have its effect on particular problems, should not be swamped by work of transitory and local value.

DISCUSSION

The CHAIRMAN said that it was very much easier to get an idea of the sort of problems which the Unit was trying to tackle if the work was seen, and he suggested that members of the Conference in the neighbourhood of Cambridge should visit it. Criticisms and suggestions were welcomed.

In the name of the Industrial Health Research Board, and of the Medical Research Council, he wished to propose a hearty vote of thanks to all the speakers who had helped to make the Conference so great a success, including those who had contributed from the floor. He hoped that the Conference would be the first of several to be arranged at various places between various people, so that it would not be too long a time before some really good results were achieved.

Dr. GOLDBLATT wished to associate himself with what Professor Bartlett had said. Might he also add one or two comments about the many things they had heard that day, particularly from the point of view of the doctor in industry? One could not go about in industry without feeling that doctors were faced with all kinds of dilemmas which left them frustrated and dissatisfied, mainly as regards the degree of attention which they obtained from the industrialists who had the power to implement their recommendations. It was relevant to refer to the remarks of Dr. McClean, who, speaking for his Association, had mentioned the pressure being brought to bear on the Trades Union Congress on the question of a national industrial medical service. Dr. McClean had suggested that there was no mention of industrial health in the Government White Paper; there was, in fact, considerable reference to it, but the reference was not satisfactory. How far the doctors in industry would welcome the service Dr. McClean had in mind would be in proportion with their agreement with the principles he had in mind. He (Dr. Goldblatt) was not sure whether the majority, or even a significant proportion of these doctors would view with satisfaction the possibility of their becoming government inspectors. Medical officers in industry had the feeling that unless they had the heart and will of the employers, unless they could win their co-operation and interest for the well-being of the workers, the whole scheme might become a mere vista of inspection with only minimal requirements fulfilled, while industrial success depended upon the attainment of optimal and maximal requirements.

The vote of thanks was accorded by applause, and the Conference terminated.

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MEDICAL RESEARCH COUNCIL

OTHER WAR-TIME PUBLICATIONS OF THE INDUSTRIAL HEALTH RESEARCH BOARD

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